

REMARKS

This amendment, filed in reply to the Office Action dated June 27, 2007, is believed to be fully responsive to each point of the rejection raised therein. Accordingly, favorable reconsideration and allowance of the subject application are respectfully requested.

Status of Claims

Claims 1-4, 19, 20, and 21 are all the claims pending in the application. Claims 5-18 are withdrawn from examination. Claim 21 is added. No new matter is introduced.

Rejection under 35 U.S.C. § 102

Claims 1-4 are rejected under 35 U.S.C. § 102(a) as being anticipated by Kanegae et al. (U.S. Pat. No. 2002/0061654 A1; hereinafter, "Kanegae"). Applicant respectfully traverses this rejection.

The claimed invention relates to "a semiconductor device comprising: an organic insulating film having an opening, wherein **said organic insulating film has an insulated modified portion** in a side of said opening, **and said modified portion includes nitrogen atoms and carbon atoms**."

In contrast, Kanegae discloses a semiconductor having a interlayer insulating film made of an organic/inorganic hybrid film represented by $\text{SiC}_x\text{H}_y\text{O}_z$ ($x>0$, $y\geq 0$, $z>0$). Kanegae teaches that "when gas containing nitrogen come into contact with the surface of the organic/inorganic hybrid film, the " C_xH_y " is chemically changed to highly volatile HCN or CN at the surface of the $\text{SiC}_x\text{H}_y\text{O}_z$ film, and thus the proportion of the carbon component decreases in the surface portion

of the organic/inorganic film.” See paragraph [0067]. Kanegae further teaches that the result is a reformed layer, e.g. 104b, where carbon component has been eliminated is formed. This reformed layer is close to the composition of SiO_2 or silicon oxide. See paragraph [0163]. A skilled artisan will know that the nitrogen atoms are expelled away in the form of the volatile HCN or CN gases as clearly shown in fig. 3. In the present invention, as shown in Fig. 8, the modified portion containing nitrogen and carbon atoms at least is formed in the side of the opening of the organic insulating film (Fig. 9). In Kanegae, There is no description on inclusion of nitrogen atoms at the modified portion in the side of the opening , and in paragraph [0306] it is clearly described that the side of the opening (710) does not contain carbon atoms. Therefore, Kanegae does not teach or suggest that “said modified portion includes nitrogen atoms and carbon atoms” as recited in claim 1. For at least these reasons, Applicant respectfully submits that the Kanegae does not anticipate the claimed invention.

The Examiner asserts that Kanegae teach that “said modified portions includes nitrogen atoms.” To support this assertion, the Examiner cites paragraphs [0163-0166], “such as HCN or CN; also see figs 5(a) -7, where it also shows concentrations of nitrogen- N_{1s}].”. Applicant disagrees and respectfully submits the cited portion does not anticipate the claimed invention. Fig. 3 of Kanegae depicts the semiconductor comprising an organic/inorganic film (104) represented by $\text{SiC}_x\text{H}_y\text{O}_z$. The organic/inorganic film is subjected to a plasma etching processed explained in paragraph [0162]. Kanegae teaches that “the etching species such as N_2 [nitrogen] contained in the plasma are attracted to the bottom of the contact hole (104a), and reacts with carbon atoms and hydrogen atoms existing on the bottom. Thus, on the bottom of the contact

hole 104a, a reformed layer (oxidized region) 104b where the carbon component has been eliminated is formed. The Examiner will appreciate that Kanegae in the same paragraph teaches that “a volatile reaction product such as HCN or CN is generated. Fig. 3 also using the arrows the chemical reaction during the plasma etching process. The Examiner will appreciate that the nitrogen atoms are not fused in the portion 104b, rather they are expelled as HCN and CN. Based on these teachings, Applicant respectfully submits that Kanegae does not teach or suggest that a modified portions includes nitrogen. Therefore, Applicant respectfully requests the withdrawal of this rejection.

Claim 2 is patentable at least by virtue of its dependency on claim 1. In addition, Kanegae does not teach or suggest that “the semiconductor device according to claim 1, wherein said modified portion further **comprises fluorine atoms, and a concentration of said fluorine atoms in said modified portion is lower than a concentration of said nitrogen atoms**”, as recited in claim 2. Rather, Kanegae teaches that the “reformed portion” is close to the composition of SiO₂ or silicon oxide, which contains neither nitrogen nor fluorine atoms. See paragraph [0163]. The Examiner relies on the teaching of paragraphs [0064-0065 and 0068-0070] and also paragraph [0097]. Applicant respectfully submits that the portion cited relates to the organic/inorganic hybrid film 104 and not the portion 104b, see paragraph [0166, lines 14-21]. Therefore, Applicant respectfully submits that Kanegae does not teach or suggest the claimed invention as recited in claim 2.

Claims 3 and 4 are patentable at least by virtue of their dependency upon claim 1 and the same reasons presented above.

Rejection under 35 U.S.C. § 103

Claims 19-20 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Kanegae in view of Shinichi (Japan Pat. Appl. Pub. 2000-114367; hereinafter, "Shinichi"). Applicant respectfully traverses this rejection.

Claims 19 and 20 are patentable at least by virtue of their dependency on claim 1. Further Shinichi does not remedy the noted deficiencies in the teachings of Kanegae. Therefore, Applicant respectfully submits that these claims are not rendered obvious by Kanegae and Shinichi either taken alone or in combination. Applicant respectfully requests the withdrawal of this rejection and earnestly solicits the allowance of all the claims in this application.

Conclusion

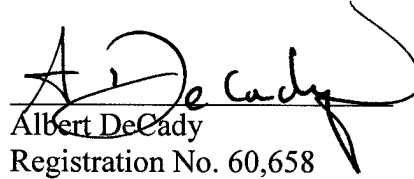
In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appl. No.: 10/509,898

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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